Measurement and Analysis of ITS-G5 in Railway Environments

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Outline

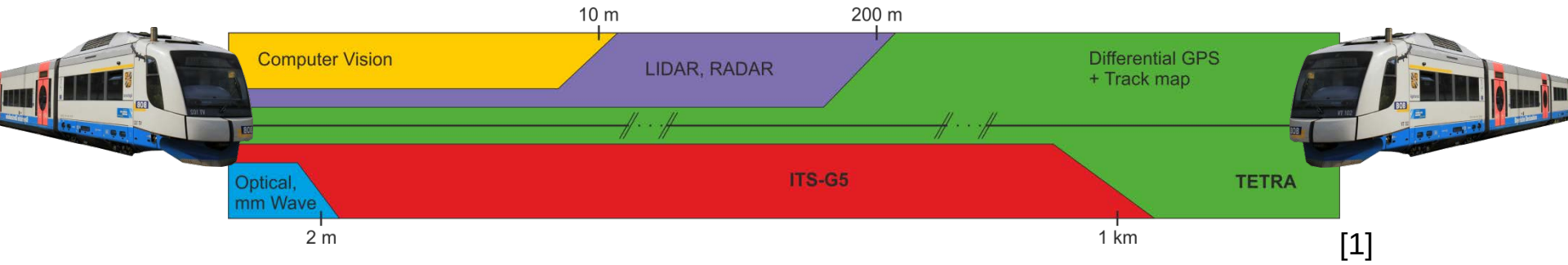
- Motivation
- Measurement setup
- Environment and scenarios
- Measurement results and analysis
- Conclusion and Outlook

Motivation (1)

Future wireless railway communications

- Reliable
- Low latency
- High throughput

- Safety critical
- Interoperable



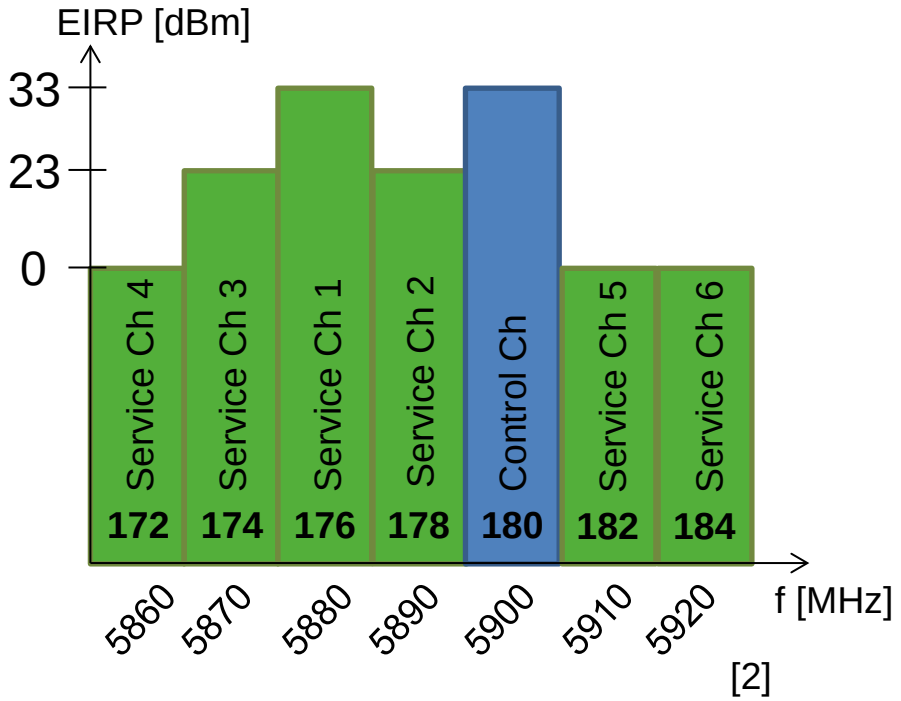
[1]

Motivation (2)

Intelligent Transportation System ITS-G5

- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Infrastructure (V2I)

- ITS frequency allocation
  - Service Channel (Ch) 3,4
    ITS- non-safety applications
  - Control Ch + Service Ch 1,2
    ITS road safety
  - Service Ch 5,6
    Future ITS applications



[2]

Measurements Setup

Cohda ITS-G5
- Transmitter (Tx) - Train
- Receiver (Rx) - Car

Dual channel operation:
- Control channel: **Ch 180 - 6 Mbps**
- Service channel 1: **Ch 176 - 3 Mbps**
- 10 MHz bandwidth
- 21 or 24 dBm output power
- 100 Hz message repetition rate
- Message length 150 and 400 Byte

[3]

BOB – Route network

[4]

Environments

- Urban area
- Rural area

- Tunnel
- Cross bridge

- Open field
- Forest

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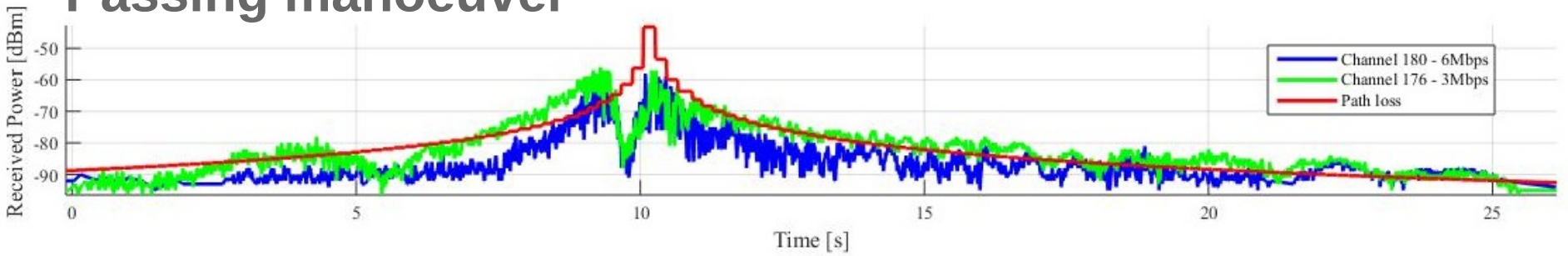
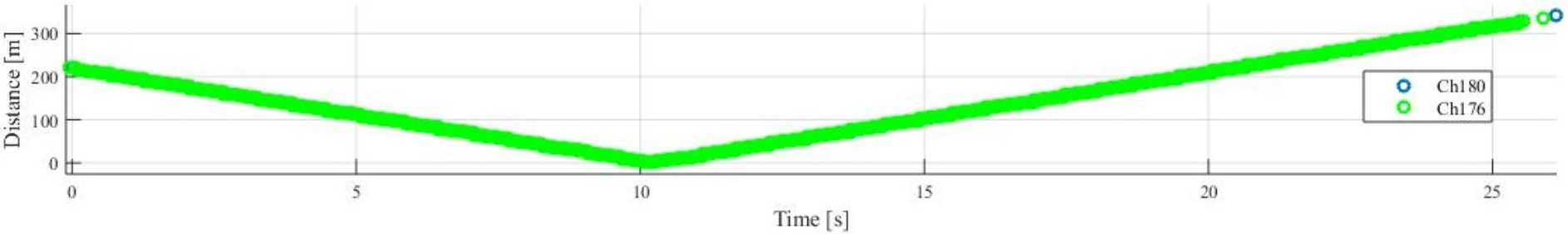
Scenarios

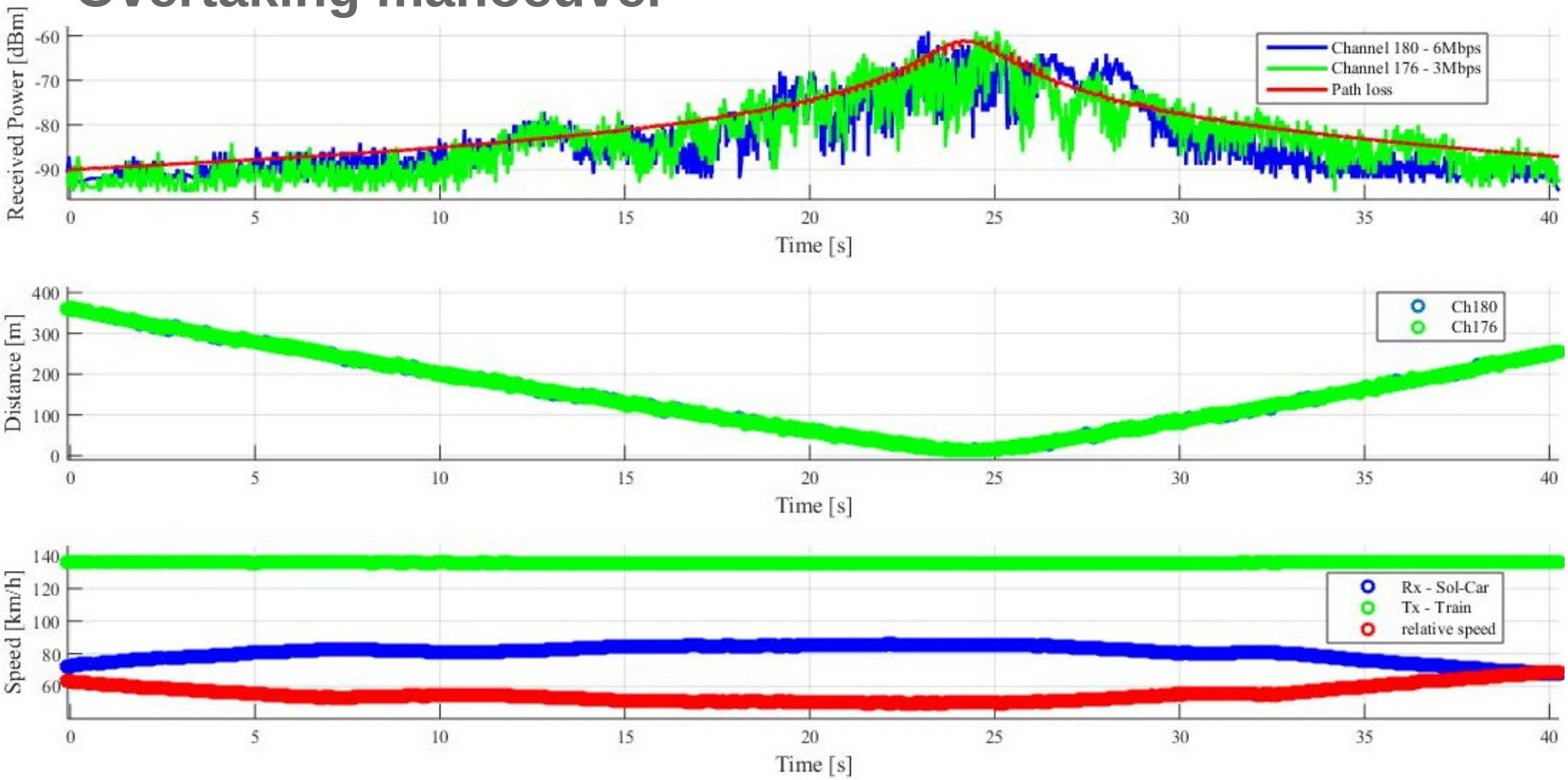
Video see attachment

Passing manoeuver

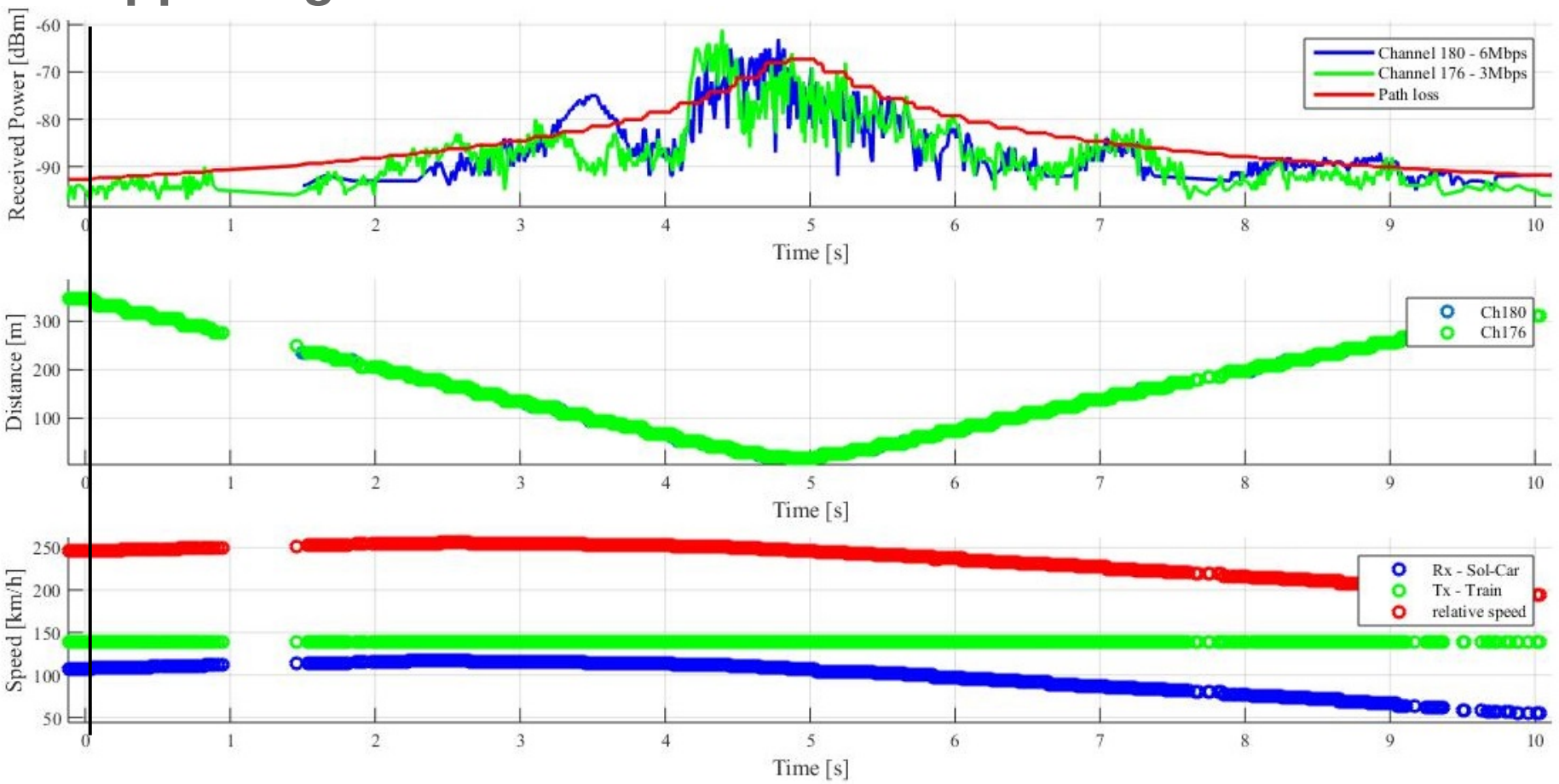


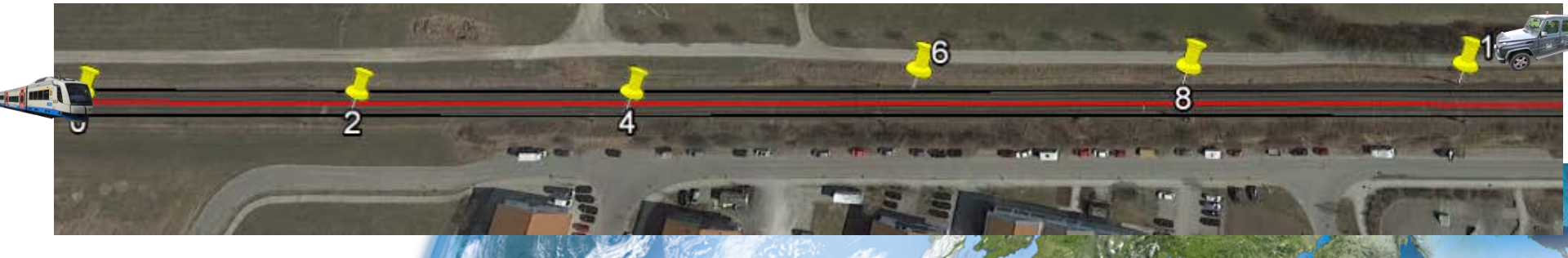


Overtaking manoeuver



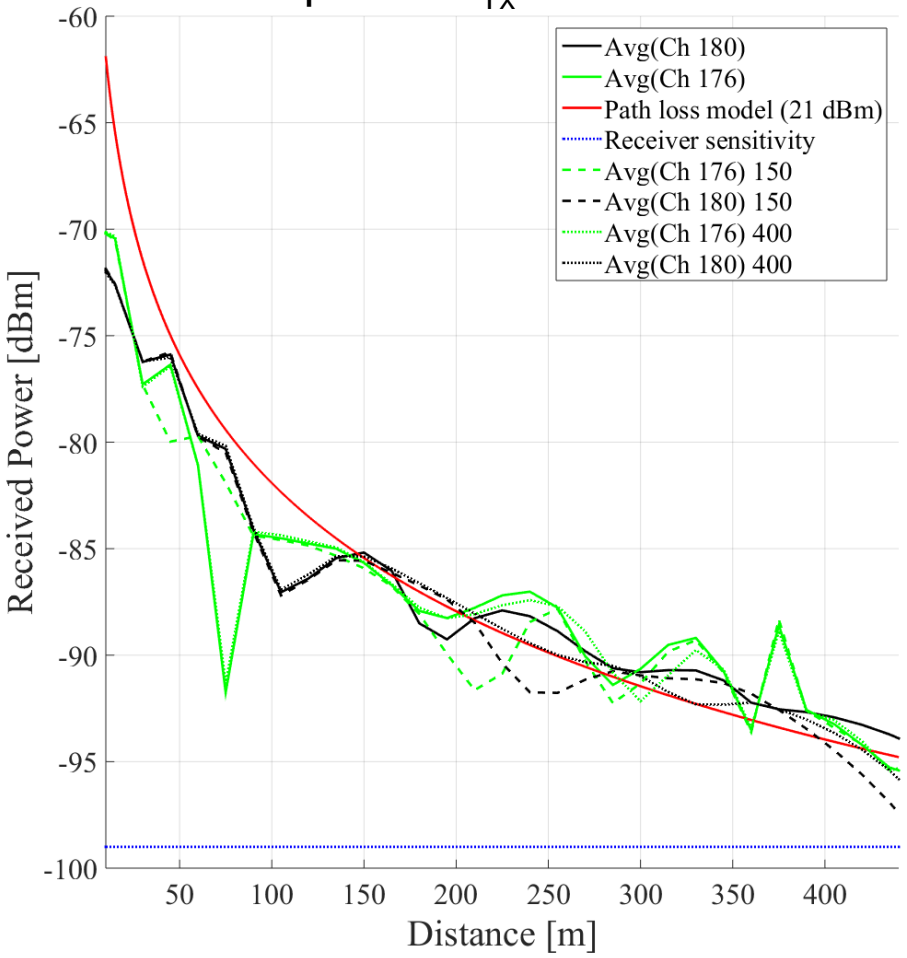
Opposing manoeuver



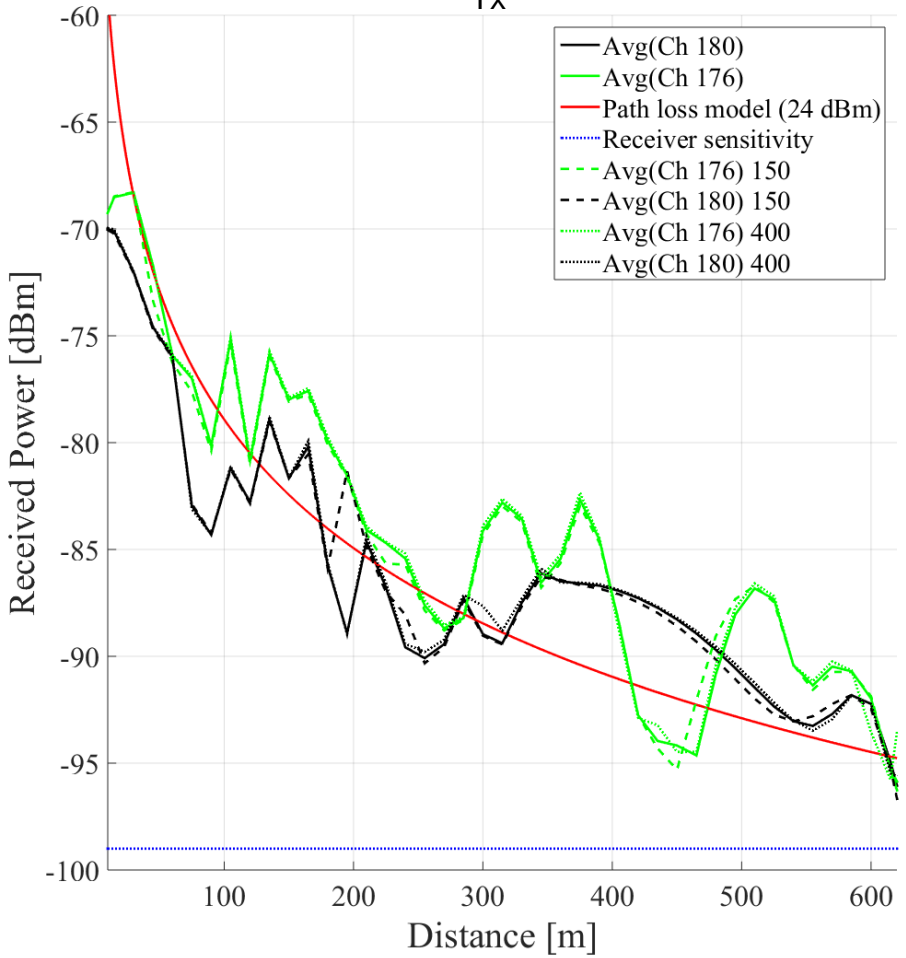


Coverage

Transmit power P_{Tx} = 21 dBm



P_{Tx} = 24 dBm



Conclusion and Outlook

- ITS-G5 can handle different railway environments
- Coverage
  - P_{Tx} = 21 dBm ~ 400 m
  - P_{Tx} = 24 dBm ~ 600 m

  $\Rightarrow P_{Tx}$ = 33 dBm ~ 1200 m
- Update Delay of ITS-G5 is sufficient for railway applications
- Further measurements on High Speed Trains

Thank you for your attention!

Questions?

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References

- [1] DLR Next Generation Train, „http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10467/740_read-916/#/gallery/2043“, 2015
- [2] ETSI EN 302 663, „Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band”, 2013
- [3] Cohda Wireless, “http://cohdawireless.com/Products/Hardware.aspx”, October 2015
- [4] Bayerische-Oberlandbahn GmbH, “http://www.bayerischeoberlandbahn.de/”, October 2015